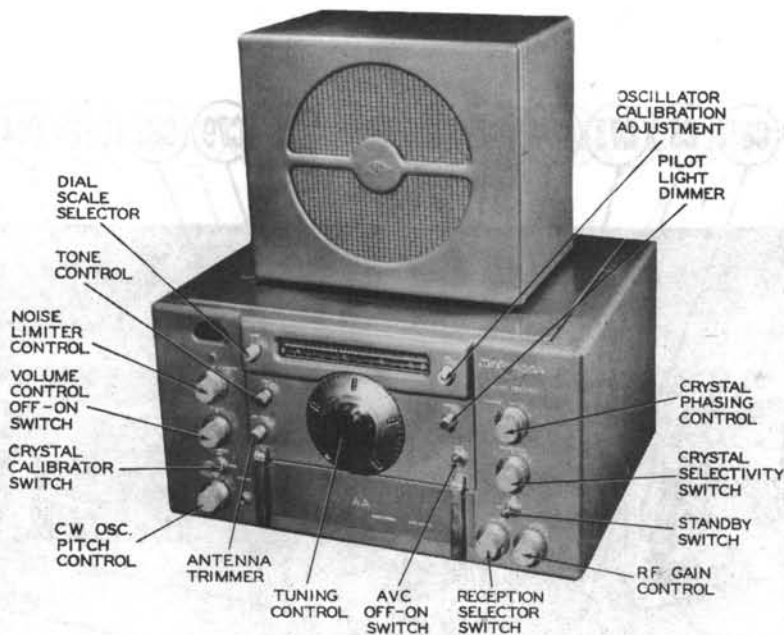


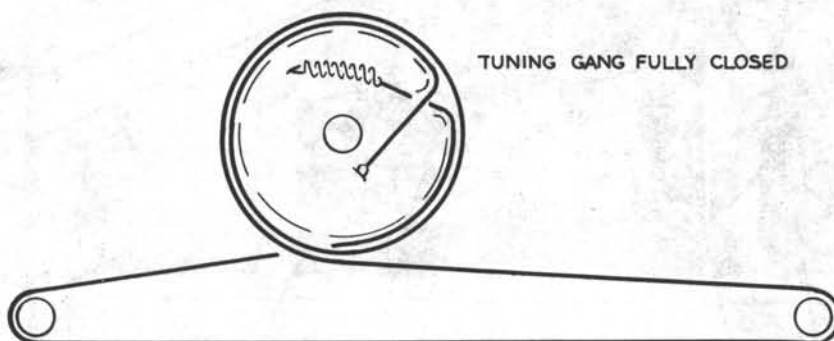


NATIONAL  
MODEL HRO-50



NATIONAL MODEL HRO-50

TRADE NAME	National, Model HRO-50 (Accessories-NFM-50, XCU 100/1000)
MANUFACTURER	National Co. Inc., Malden, Mass.
TYPE SET	AC Operated Multi-Band Communications Receiver (Accessories-Narrow Band FM Adaptor, Crystal Calibrator Unit)
TUBES(SEVENTEEN)	Types 6BA6 1st RF Amp., 6BA6 2nd RF Amp., 6BE6 Mixer, 6C4 HF Osc., 6K7 1st IF Amp., 6K7 2nd IF Amp., 6J7 BFO, 6H6 DET-AVC, 6SN7GT 8 Meter Amp. -Phase Inv., 6H6 Noise Limiter, 6SJ7 Audio Amp., (2) 6V6GT Power Output, 0B2 Voltage Regulator, 5U4G Rectifier, 6AK6 Crystal Osc., 6SK7 FM IF Amp., 6H6 Ratio Det.
POWER SUPPLY	110-120 or 220-240 Volts AC
RATING	.95 Amp. at 117 Volts AC
TUNING RANGE	Band "A" 14-30MC, "B" 7-14.4MC, "C" 3.5-7.3MC, "D" 1.7-4MC, "E" 900-2050KC, "F" 480-960KC, "G" 180-430KC, "H" 100-200KC, "J" 50-100KC, "AA" 27.5-30MC, "AB" 25-35MC, "AC" 21-21.5MC



TUNING GANG FULLY CLOSED

DIAL CORD DRIVE

HOWARD W. SAMS & CO., INC. • Indianapolis 1, Indiana

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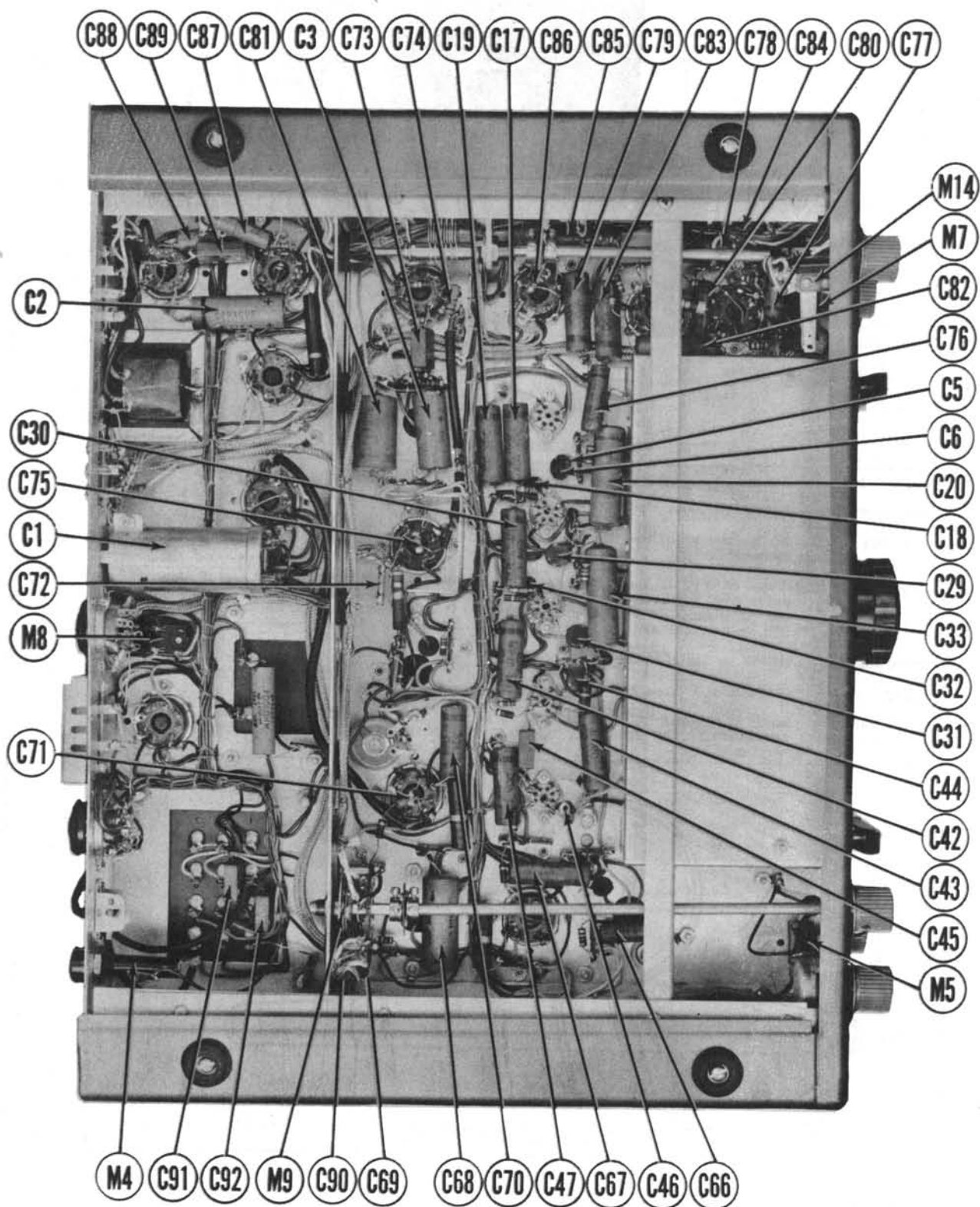
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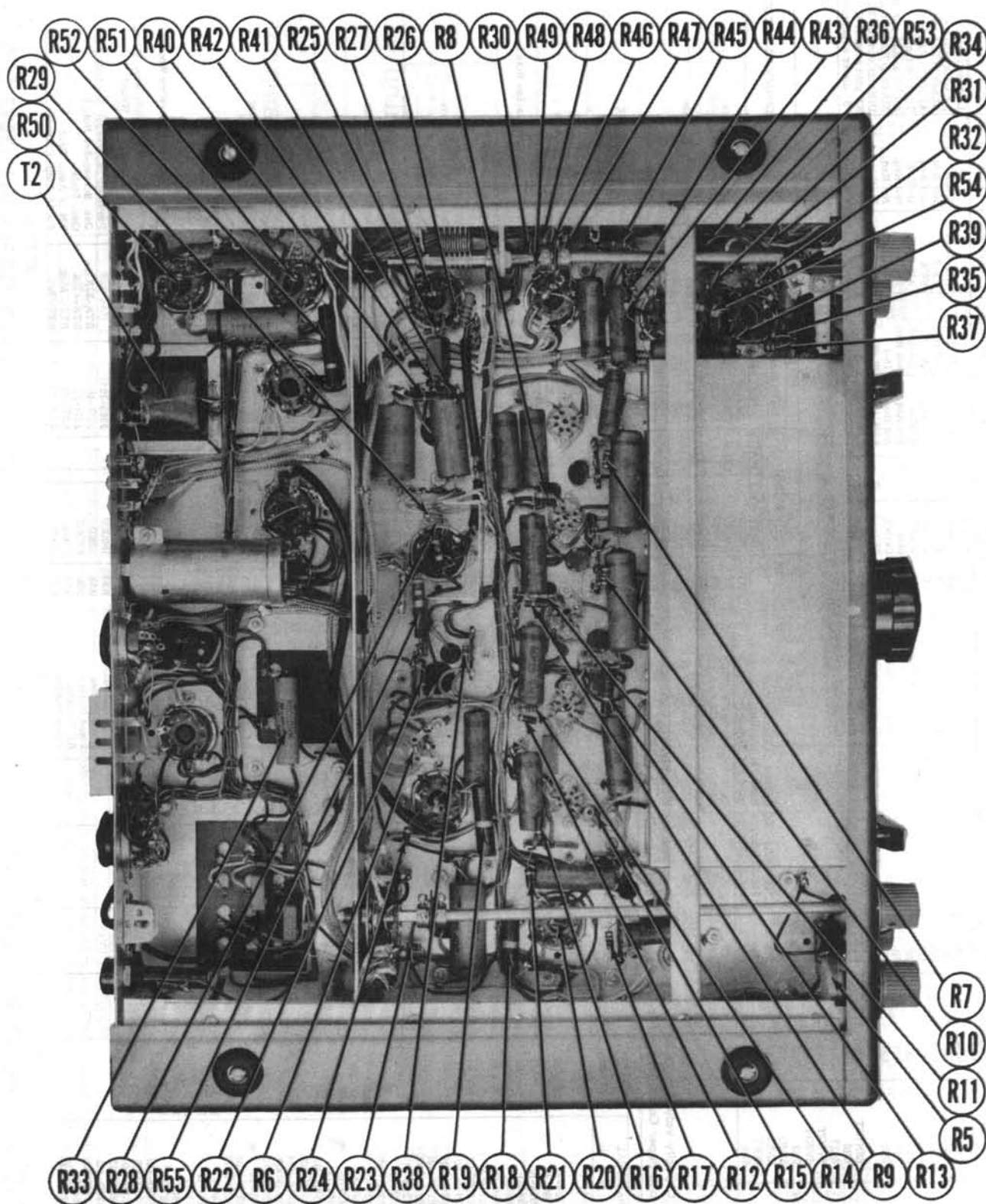
DATE 11-50

SET 112

FOLDER 7

www.everything4lessstore.com  
NATIONAL  
MODEL HRO-50





# PARTS LIST AND DESCRIPTIONS

## TUBES (SYLVANIA or Equivalent)

ITEM No.	USE	REPLACEMENT DATA			NOTES
		NATIONAL PART No.	STANDARD REPLACEMENT	EMA BASE TYPE	
V1	1st RF Amp.	6BA6	6BA6	7BK	
V2	2nd RF Amp.	6BA6	6BA6	7BK	
V3	Mixer	6BE6	6BE6	7C4	
V4	RF Oscillator	6C4	6C4	7R	
V5	1st IF Amp.	6K7	6K7	7R	
V6	2nd IF Amp.	6K7	6K7	7R	
V7	BF Oscillator	6K7	6K7	7R	
V8	Det.-AVC	6H6	6H6	7Q	
V9	"S" Meter Amp. - Phase Inv.	6SN7GT	6SN7GT	8BD	
V10	Noise Limiter	6H6	6H6	7Q	
V11	Audio Amp.	6S17	6S17	8N	
V12	Power Output	6V6GT	6V6GT	7AC	
V13	Power Output	6V6GT	6V6GT	7AC	
V14	Voltage Regulator	0B2	0B2	5BO	
V15	Rectifier	504G	504G	5T	
V16	Crystal Osc.	6AX6	6AX6	7BK	
V17	FM IF Amp.	6SK7	6SK7	8N	
V18	Ratio Det.	6H6	6H6	7Q	

# CAPACITORS

Capacity values given in the rating column are in mfd. for Electrolytic and Paper Capacitors, and in mmd. for Mica and Ceramic Capacitors.

ITEM No.	RATING CAP. VOLT	REPLACEMENT DATA			IDENTIFICATION AND INSTALLATION NOTES
		NATIONAL PART No.	AEROVOX PART No.	CENTRALAB PART No.	
C1A	40	K945-3	AF88K	UP4450	
B	475				
C2	25	K338-4	PRS350/25	BR255A	Output Cath. Bypass
C3	25	K338-4	PRS350/25	BR255A	• Filter
C4	1	K946-1	PRS450/4	BR145	Tone Comp.
C5	5000	K946-1	BPD-005	ID5D5	Stabilizing Cap.
C6	5000	K946-1	BPD-005	ID5D5	AVC Filter
C7	10000	7666-56	1467-01	DE-103	AVC Filter
C8	12	D82SD-404			Fixed Padder
C9	5	D82SD-401			Fixed Padder
C10	12	D82SD-404			Fixed Padder
C11	25.7	D82SD-412			Fixed Padder
C12	5	D82SD-402			Fixed Padder
C13	10	D82SD-412			Fixed Padder
C14	50	D82SD-417			Fixed Padder
C15	1200	7666-16			Fixed Padder
C16	120	D82SC-305			Fixed Padder
C17	1	D82T-11	P488-1	PT84P1	Fixed Padder
C18	400	K946-1	BPD-005	ID5D5	Fixed Padder
C19	5000	D82T-11	P488-1	PT84P1	Fixed Padder
C20	1	D82T-13	P888-1	PT86P1	Fixed Padder
C21	21	D82SD-410			Fixed Padder
C22	5	D82SD-401			Fixed Padder
C23	12	D82SD-404			Fixed Padder
C24	27.5	D82SD-412			Fixed Padder
C25	21	D82SD-410			Fixed Padder
C26	470	7666-56			Fixed Padder
C27	100	D82SC-304			Fixed Padder
C28	88	D82SD-439			Fixed Padder
C29	5000	K946-1	BPD-005	ID5D5	Fixed Padder
C30	400	D82T-11	P488-1	PT84P1	Fixed Padder
C31	5000	K946-1	BPD-005	ID5D5	Fixed Padder
C32	5000	K946-1	BPD-005	ID5D5	Fixed Padder
C33	1	D82T-13	P888-1	PT86P1	Fixed Padder
C34	21	D82SD-410			Fixed Padder
C35	5	D82SD-401			Fixed Padder
C36	12	D82SD-404			Fixed Padder
C37	27.5	D82SD-412			Fixed Padder
C38	5	D82SD-401			Fixed Padder
C39	100	D82SC-304			Fixed Padder
C40	470	7666-56			Fixed Padder
C41	88	D82SD-439			Fixed Padder

# PARTS LIST AND DESCRIPTIONS (Continued)

## CONTROLS

ITEM No.	RATING RESIST. ANCE	WATTS	REPLACEMENT DATA			IDENTIFICATION NOTES
			NATIONAL PART No.	IRC PART No.	CLEARSTAY PART No.	
R1	500KΩ	1	J681-2	Q13-133	AM-60-Z	Limiter control and switch
R2	500KΩ	1	K347-1	Not Req.	Not Req.	AF Gain control
R3	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R4	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R5	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R6	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R7	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R8	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R9	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R10	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R11	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R12	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R13	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R14	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R15	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R16	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R17	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R18	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R19	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R20	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R21	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R22	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R23	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R24	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R25	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R26	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R27	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R28	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R29	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R30	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R31	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R32	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R33	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R34	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R35	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R36	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R37	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R38	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R39	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R40	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R41	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R42	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R43	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R44	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R45	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R46	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R47	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R48	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R49	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R50	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R51	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R52	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R53	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R54	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R55	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R56	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R57	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R58	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R59	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R60	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions
R61	500KΩ	1	K347-1	Not Req.	Not Req.	Attach to R2A per instructions

# RESISTORS

ITEM No.	RATING RESISTANCE	WATTS	REPLACEMENT DATA			IDENTIFICATION CODES
			NATIONAL PART No.	IRC PART No.	CLEARSTAY PART No.	
R7	470KΩ	1	J569-57	BTS-470K		AVC Network
R8	100KΩ	1	J569-13	BTS-100		1st RF Amp. Cathode
R9	220KΩ	1	J569-29	BTS-220K		RF Screen Dropping
R10	470KΩ	1	J569-57	BTS-470K		AVC Network
R11	560Ω	1	J569-22	BTS-560		2nd RF Amp. Cathode
R12	22KΩ	1	J569-41	BTS-22K		Mixer Grid
R13	33KΩ	1	J571-43	BTA-33K		Mixer Screen
R14	220Ω	1	J569-17	BTS-220		Dimmer Cathode
R15	22KΩ	1	J569-41	BTS-22K		Osc. Grid
R16	22Ω	1	J569-57	BTS-22		Parasitic Suppressor
R17	470KΩ	1	J572-42	BTS-470K		AVC Network
R18	27KΩ	1	J572-39	BTS-27K		Voltage Divider
R19	15KΩ	1	J569-17	BTS-15K		Screen Dropping
R20	220Ω	1	J569-19	BTS-220		1st IF Amp. Cathode
R21	330Ω	1	J569-29	BTS-330		Plate Decoupling
R22	220KΩ	1	J569-57	BTS-220K		AVC Network
R23	470KΩ	1	J569-17	BTS-470K		BTS-220
R24	220KΩ	1	J569-49	BTS-220K		2nd IF Amp. Cathode-See Note 1
R25	100KΩ	1	J569-13	BTS-100K		Voltage Divider
R26	100KΩ	1	J569-49	BTS-100K		BRO Screen
R27	220KΩ	1	J569-53	BTS-220K		AVC Diode Load
R28	1.5 Meg.	1	J569-63	BTS-1.5 Meg.		"S" Meter Amp. Plate
R29	1.5 Meg.	1	J569-63	BTS-1.5 Meg.		Diode Filter
R30	47KΩ	1	J569-45	BTS-47K		"S" Meter Amp. Plate
R31	22KΩ	1	J569-41	BTS-22K		Det. Diode Load
R32	470KΩ	1	J569-57	BTS-470K		Decoupling-Wire Wound
R33	500KΩ	1	J569-53	BTS-500K		Voltage Divider
R34	220KΩ	1	J569-53	BTS-220K		Noise Limiter Plate
R35	220KΩ	1	J569-53	BTS-220K		Noise Limiter Plate
R36	220KΩ	1	J569-53	BTS-220K		Noise Limiter Plate
R37	470KΩ	1	J569-57	BTS-470K		Decoupling
R38	820KΩ	1	J569-60	BTS-820K		Voltage Divider
R39	220KΩ	1	J569-53	BTS-220K		Audio Amp. Cathode
R40	220KΩ	1	J569-29	BTS-220		Audio Amp. Cathode
R41	150Ω	1	J569-15	BTS-150		Feedback
R42	680Ω	1	J569-35	BTS-680		Audio Amp. Screen
R43	100KΩ	1	J569-49	BTS-100K		Audio Amp. Plate
R44	100KΩ	1	J569-49	BTS-100K		Audio Amp. Decoupling
R45	100KΩ	1	J569-49	BTS-100K		Phase Inv. Cathode
R46	220KΩ	1	J569-53	BTS-220K		Phase Inv. Cathode
R47	470KΩ	1	J569-57	BTS-470K		Phase Inv. Cathode
R48	47KΩ	1	J569-45	BTS-47K		Phase Inv. Cathode
R49	47KΩ	1	J569-45	BTS-47K		Phase Inv. Cathode
R50	220KΩ	1	J569-53	BTS-220K		Audio Output Grid
R51	220KΩ	1	J569-53	BTS-220K		Audio Output Grid
R52	220KΩ	1	J569-53	BTS-220K		Audio Output Cathode-Wire Wound
R53	470Ω	1	J572-21	BTS-470		Voice Coil Shunt
R54	470Ω	1	J572-21	BTS-470		Noise Limiter Cathode-Wire Wound
R55	4.3K	1	K098-34			Det. Filament-Wire Wound
R56	4.3K	1	K098-34			Osc. Grid
R57	150Ω	1	J569-15	BTS-150		Parasitic Suppressor-See Note 2
R58	22KΩ	1	J571-41	BTS-22K		Osc. Plate
R59	470KΩ	1	J571-57	BTS-470K		FM IF Amp. Grid
R60	1 Meg.	1	K379-61	BTS-1-Meg.		FM IF Amp. Cathode
R61	100KΩ	1	K379-25	BTS-100K		FM IF Amp. Cathode



## CAPACITORS

## PARTS LIST AND DESCRIPTIONS (Continued)

## RESISTORS

• Not used in all models.

Note 3: Some models use a 2200Ω, 1 watt resistor in this application.

### TRANSFORMER (POWER)

② Add series resistor to reduce plate voltage.

## TRANSFORMER (AUDIO OUTPUT)

**SPEAKER**

1

## FILTER CHOKE

### COILS (RF-IF)

# **PARTS LIST AND DESCRIPTIONS (Continued)** COILS (RF-IF)

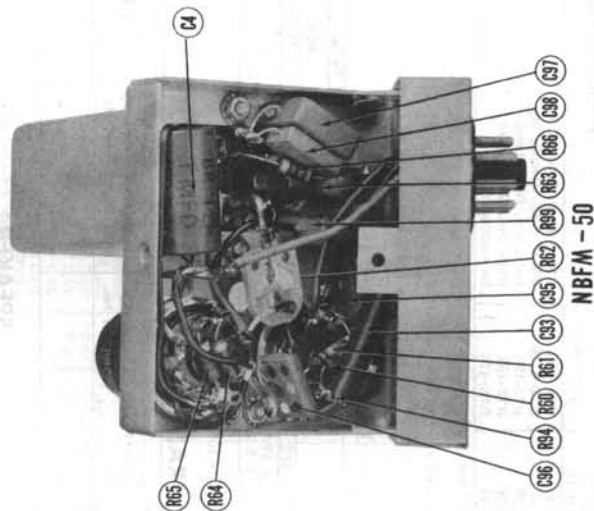
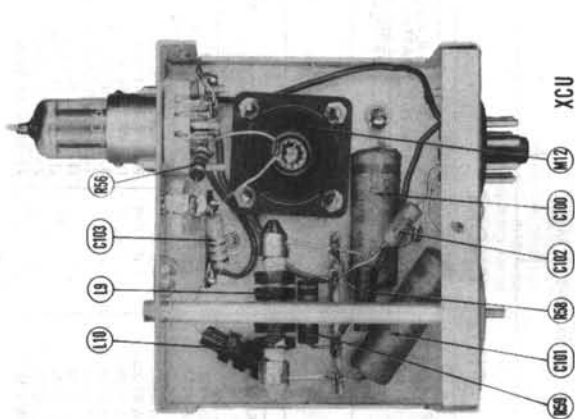
ITEM No.	USE	DC RES.		REPLACEMENT DATA		NOTES
		PRI.	SEC.	NATIONAL PART No.	MEISSNER PART No.	
L3A	1st RF Trans.	.10	.10	SA-5609		50-100KC J Band
B	1st RF Trans.			SA-5669		100-200KC H Band
C	1st RF Trans.			SA-5667		180-430KC G Band
D	1st RF Trans.			SA-5662		480-960KC F Band
E	1st RF Trans.			SA-5540		900-2050KC E Band
F	1st RF Trans.			SA-5637		1.7-4MC D Band
G	1st RF Trans.			SA-5641		3.5-7.3MC C Band
H	1st RF Trans.			SA-5650		7-14.4MC B Band
I	1st RF Trans.			SA-5751		14-30MC A Band
J	1st RF Trans.			SA-5818		21-21.5MC AC Band
K	1st RF Trans.			SA-5818		25-35MC AB Band
L	1st RF Trans.			SA-5810		27-30MC AA Band
L4A	2nd RF Trans.	.20	.10	SA-5804		50-100KC J Band
B	2nd RF Trans.			SA-5800		100-200KC H Band
C	2nd RF Trans.			SA-5794		180-430KC G Band
D	2nd RF Trans.			SA-5789		480-960KC F Band
E	2nd RF Trans.			SA-5638		900-2050KC E Band
F	2nd RF Trans.			SA-5642		1.7-4MC D Band
G	2nd RF Trans.			SA-5752		3.5-7.3MC C Band
H	2nd RF Trans.			SA-5676		7-14.4MC B Band
I	2nd RF Trans.			SA-5815		14-30MC A Band
J	2nd RF Trans.			SA-5805		21-21.5MC AC Band
K	2nd RF Trans.			SA-5795		25-35MC AB Band
L	2nd RF Trans.			SA-5631		27-30MC AA Band
L5A	HF Osc.	.10		SA-5776		50-100KC J Band
B	HF Osc.			SA-5678		100-200KC H Band
C	HF Osc.			SA-5678		180-430KC G Band
D	HF Osc.			SA-5678		480-960KC F Band
E	HF Osc.			SA-5678		900-2050KC E Band
F	HF Osc.			SA-5678		1.7-4MC D Band
G	HF Osc.			SA-5678		3.5-7.3MC C Band
H	HF Osc.			SA-5678		7-14.4MC B Band
I	HF Osc.			SA-5678		14-30MC A Band
J	HF Osc.			SA-5678		21-21.5MC AC Band
K	HF Osc.			SA-5678		25-35MC AB Band
L	HF Osc.			SA-5678		27-30MC AA Band
L6	1st IF	8.40	8.40	SA-5616		Includes trimmer, 2 capacitors and resistor.
L7	2nd IF	8.40	8.40	SA-2492		5 microhenries
L8	BFO Coil	47K0		SA-41G		.5 microhenries
L9	100KC Induct-	950		SA-3361		
L10	1000KC Induct-	170		SA-4373		
L11	Ratio Det. Trans.	80	90	SA-2514		
				SA-4890		

## **DIAL LIGHTS**

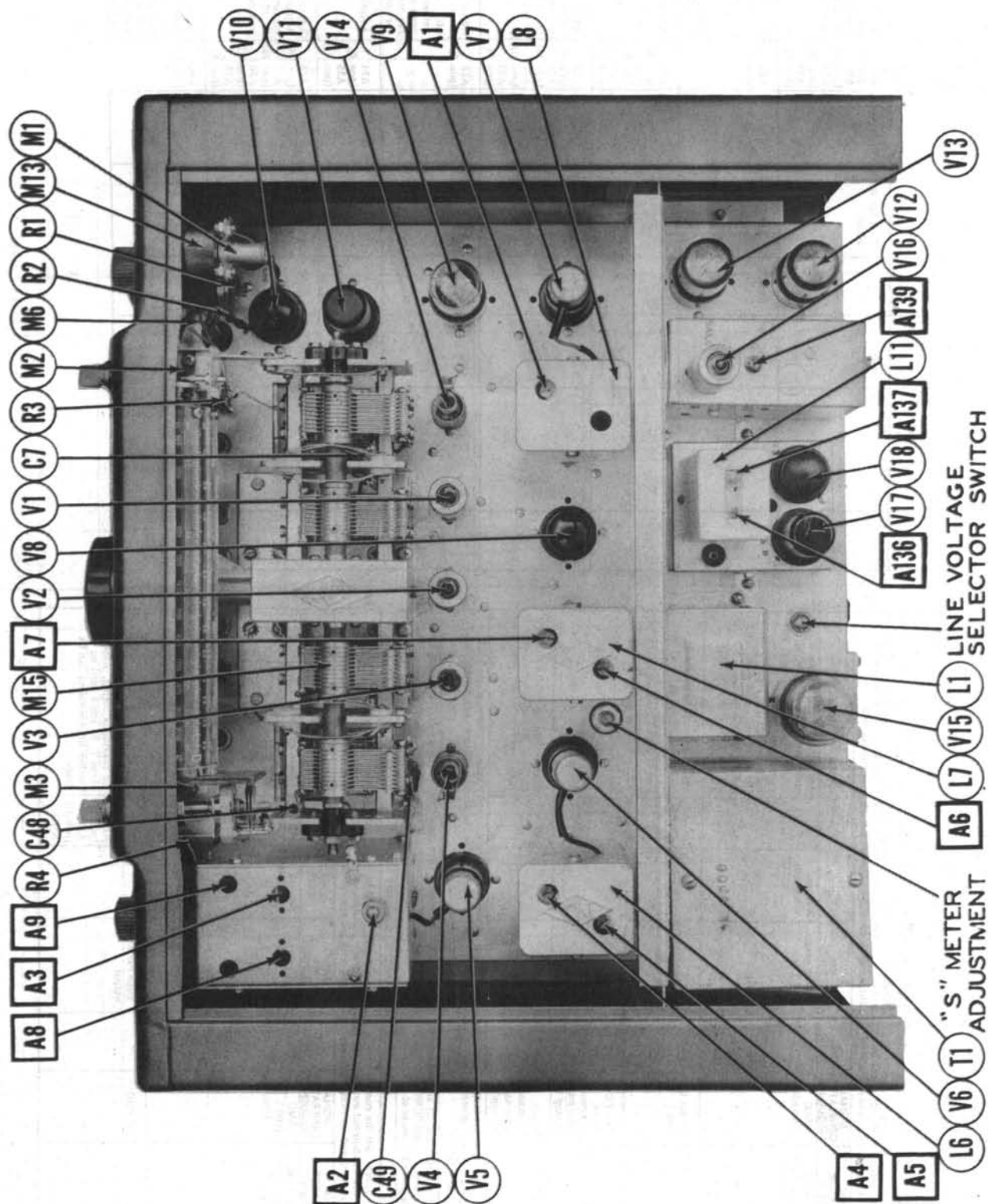
ITEM No.	BASE TYPE	VOLTS	AMPS.	REPLACEMENT DATA		NOTES
				BEAD COLOR	NATIONAL PART No.	
M1	Bayonet	6-8	.15	Brown	F136-6	Type #47
M2	Bayonet	6-8	.15	Brown	F136-6	Type #47
M3	Bayonet	6-8	.15	Brown	F136-6	Type #47

## **MISCELLANEOUS**

ITEM No.	PART NAME	NATIONAL PART No.	NOTES
M4	Fuse	F135-4	3AG 2 Amp. at 250V
M5	Switch	E230-2	B+ On-Off
M6	Switch	E230-2	AVC
M7	Switch	P738-1	Calibrate
M8	Switch	H340-4	110-120/220-240
M9	Switch	SA-6546	Function
M10	Switch	E195-3	Selectivity
M11	Crystal Filter	SA-3654	45KHC
M12	Crystal	E979-1	Carrier Level
M13	Meter	J984-5	Four Section
M14	Phone Jack	F316-1	
M15	Tuning Gang	SA-5592	



NBFM - 50



# ALIGNMENT INSTRUCTIONS (CONT.)

54.	4000 carbon res.	High side to antenna terminal "A". Low side to chassis.	14.4MC	Band B	14.4MC	Across voice coil	A112 (pos. 7)	Adjust until signal is heard. Tune signal generator to 15.31 MC. If signal is not heard, retune generator to 14.4MC and open A112 to next peak. Adjust for maximum output and recheck for image.
55.	"	"	"	"	"	"	A113 (pos. 5) A114 (pos. 3) A115 (pos. 1)	Adjust for maximum output.
56.	"	"	14MC	"	Tune for max. output	"	A116 (pos. 15) A117 (pos. 14) A118 (pos. 12) A119 (pos. 10)	Adjust A116 until signal is heard. Adjust A117, A118 and A119 for maximum output. Repeat steps 54, 55 and 56 until no further improvement can be made.
57.	"	"	7.3MC	Band C	7.3MC	"	A120 (pos. 7)	Adjust until signal is heard. Tune signal to 8.2MC. If signal is not heard, retune generator to 7.3MC and open A120 to next peak. Adjust for maximum output and recheck for image.
58.	"	"	"	"	"	"	A121 (pos. 5) A122 (pos. 3) A123 (pos. 1)	Adjust for maximum output.
59.	"	"	7MC	"	Tune for max. output	"	A124 (pos. 15) A125 (pos. 14) A126 (pos. 12) A127 (pos. 10)	Adjust A124 until signal is heard. Adjust A125, A126 and A127 for maximum output. Repeat steps 57, 58 and 59 until no further improvement can be made.
60.	"	"	4MC	Band D	4MC	"	A128 (pos. 7)	Adjust until signal is heard. Tune signal generator to 4.91 MC. If signal is not heard, retune generator to 4MC and open A128 to next peak. Adjust for maximum output and recheck for image.
61.	"	"	"	"	"	"	A129 (pos. 5) A130 (pos. 3) A131 (pos. 1)	Adjust for maximum output.
62.	"	"	3.5MC	"	Tune for max. output	"	A132 (pos. 15) A133 (pos. 14) A134 (pos. 12) A135 (pos. 10)	Adjust A132 until signal is heard. Adjust A133, A134 and A135 for maximum output. Repeat steps 60, 61 and 62 until no further improvement can be made.

46.	4000 carbon res.	High side antenna terminals "A". Low side to chassis.	30MC	Band AB	Tune for max. output	Across voice coil	A88 (pos. 16) A89 (pos. 13) A90 (pos. 11) A91 (pos. 9)	Adjust A88 until signal is heard. Adjust A89, A90 and A91 for maximum output. Repeat steps 43, 44, 45 and 46 until no further improvement can be made.
47.	"	"	21.5MC	Band AC	21.5MC	"	A92 (pos. 7)	Adjust until signal is heard. Tune signal generator to 22.41 MC. If signal is not heard, retune generator to 21.5MC and open A92 to next peak. Adjust for maximum output and recheck for image.
48.	"	"	"	"	"	"	A93 (pos. 5) A94 (pos. 3) A95 (pos. 1)	Adjust for maximum output.
49.	"	"	21MC	"	Tune for max. output	"	A96 (pos. 8) A97 (pos. 6) A98 (pos. 4) A99 (pos. 2)	Adjust A96 until signal is heard. Adjust A97, A98 and A99 for maximum output.
50.	"	"	21.3MC	"	"	"	A100 (pos. 16) A101 (pos. 13) A102 (pos. 11) A103 (pos. 9)	Adjust A100 until signal is heard. Adjust A101, A102 and A103 for maximum output. Repeat steps 47, 48, 49 and 50 until no further improvement can be made.

## BANDSPREAD ALIGNMENT

Set the bandspread switch to the bandspread position. All other controls remain the same as in GENERAL COVERAGE ALIGNMENT.							
DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	COIL SET	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
4000 carbon res.	High side to antenna terminal "A". Low side to chassis.	30MC (400 % Mod.)	Band A	30MC	Across voice coil	A104 (pos. 7)	Adjust until signal is heard. Tune signal generator to 30.91 MC. If signal is not heard, retune generator to 30MC and open A104 to next peak. Adjust for maximum output and recheck for image.
"	"	"	"	"	"	A105 (pos. 5) A106 (pos. 3) A107 (pos. 1)	Adjust for maximum output.
51.	"	"	"	"	"	A108 (pos. 15) A109 (pos. 14) A110 (pos. 12) A111 (pos. 10)	Adjust A108 until signal is heard. Adjust A109, A110 and A111 for maximum output. Repeat steps 51, 52 and 53 until no further improvement can be made.



# ALIGNMENT INSTRUCTIONS (CONT.)

Let RF STAGE ALIGNMENT WITH LOW IMPEDANCE TRANSMISSION LINE  
If a low impedance transmission line is to be used with the receiver it may be necessary to realign the first RF amplifier at the high frequency end of each band.

CRYSTAL CALIBRATOR UNIT ADJUSTMENT  
Set controls of receiver for normal CW operation.  
Set the front panel calibrate switch at the 100KC position.  
Tune in the signal from WWV and adjust A139 so that 100KC signal harmonic is zero beat with the signal received from WWV.

## GENERAL COVERAGE ALIGNMENT

Set the bandspread switch to "General Coverage" position. Coil sets A, D, E and G do not have a first RF trimmer but is peak tuned by the antenna trimmer control on front panel of receiver.						
DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	COIL SET	RADIO DIAL SETTING	OUTPUT METER	ADJUST
Direct	High side to antenna terminal "A". Low side to chassis.	14.4MC (400 % Mod.)	Band B	Tune for max. output	Across voice coil	A20 (pos. 2) Adjust for maximum output.
63.						
64.	Direct	7.3MC	Band C	"	"	A28 (pos. 2) "
65.	Direct	900KC	Band F	"	"	A48 (pos. 2) "
66.	Direct	200KC	Band H	"	"	A59 (pos. 2) "
67.	Direct	100KC	Band J	"	"	A65 (pos. 2) "
68.	Direct	30MC	Band AA	"	"	A71 (pos. 1) "
69.	Direct	35MC	Band AB	"	"	A83 (pos. 2) "
70.	Direct	21.5MC	Band AC	"	"	A95 (pos. 1) "

## BANDSPREAD ALIGNMENT

Set the bandspread switch to "Bandspread" position.						
DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	COIL SET	RADIO DIAL SETTING	OUTPUT METER	ADJUST
71.	Direct	High side to antenna terminal "A". Low side to chassis.	Band A	Tune for max. output	Across voice coil	A107 (pos. 1) Adjust for maximum output.
72.	Direct	"	14.4MC	Band B	"	A115 (pos. 1) "
73.	Direct	"	7.3MC	Band C	"	A123 (pos. 1) "
74.	Direct	"	4MC	Band D	"	A131 (pos. 1) "

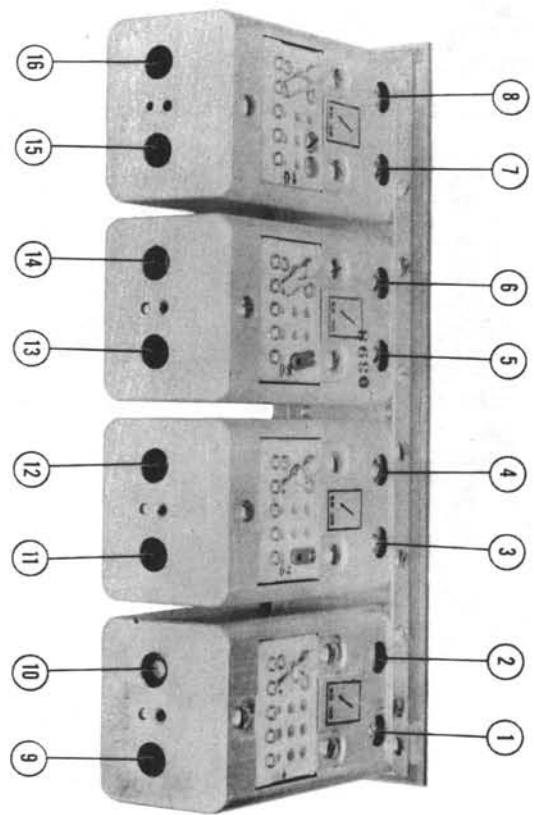
## "S" METER ADJUSTMENT

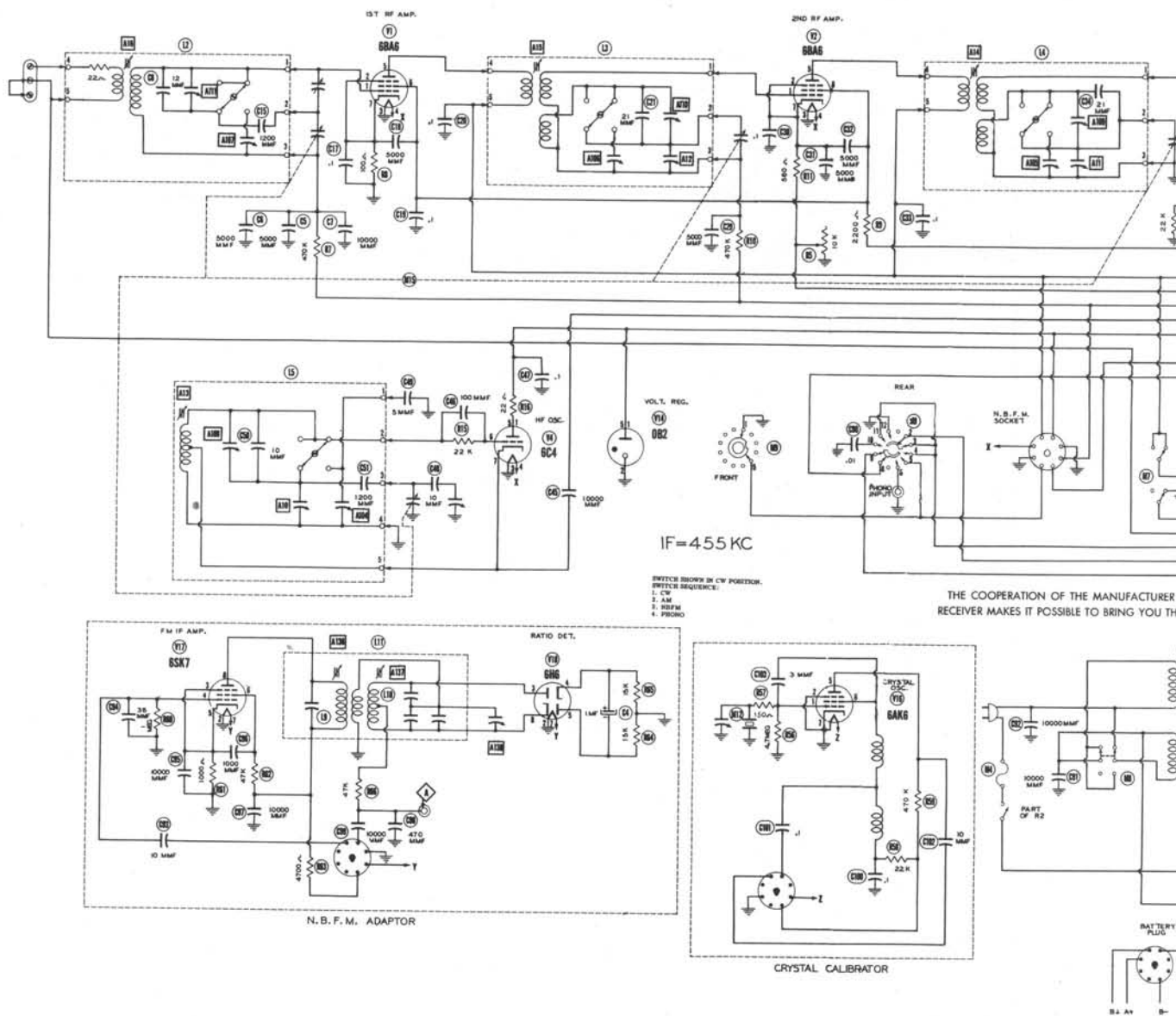
Before attempting this adjustment set the controls as follows: Set the RF gain control at zero, the AVC switch to "AVC", the control switch to "AM", and the AC switch to "ON".  
Adjust the "S" meter balancing control R8 for a zero reading on the "S" meter.

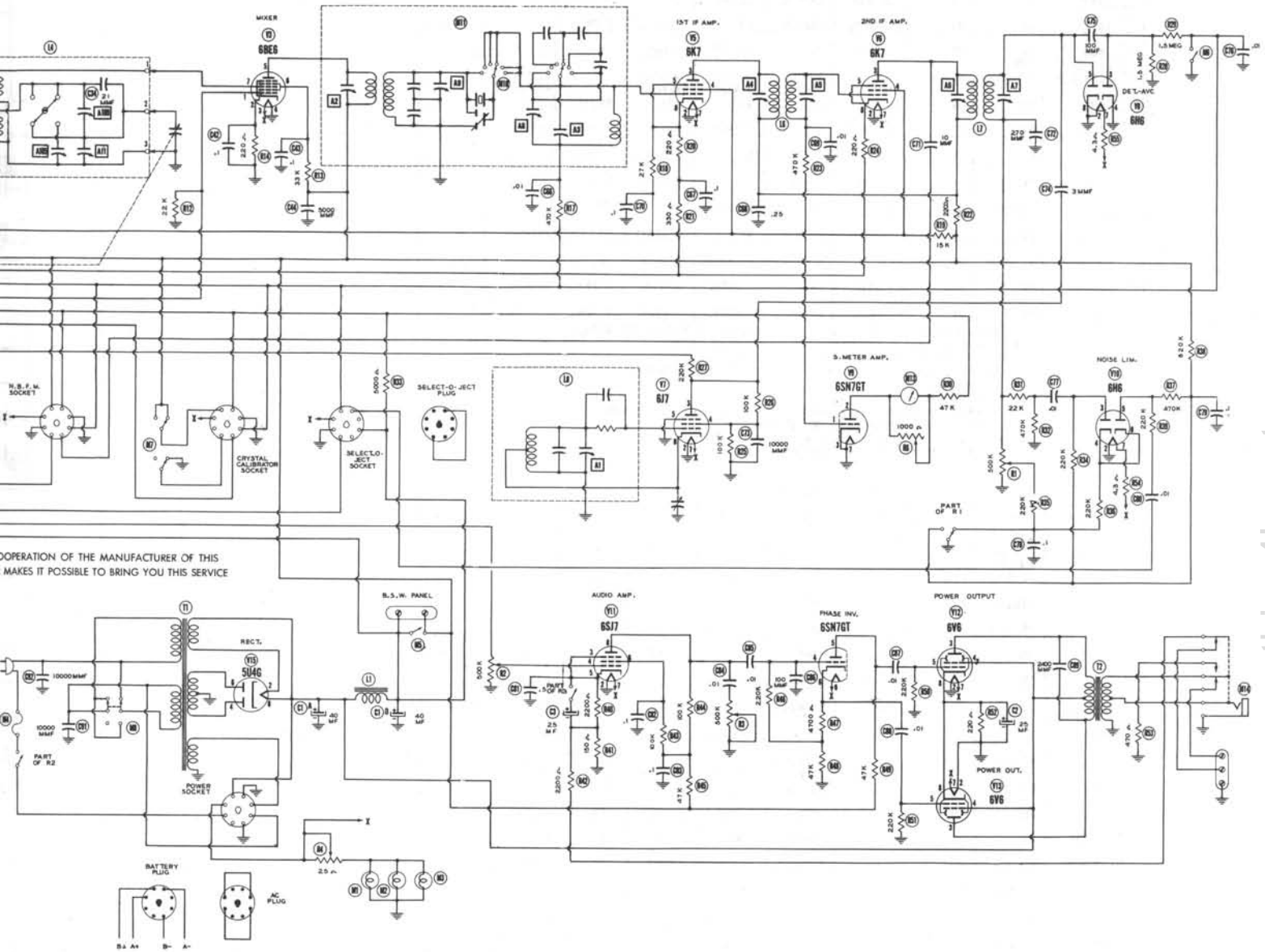
## NARROW BAND FM ADAPTOR ALIGNMENT

It will be necessary to realign primary trimmer A6 as follows: Plug in the adaptor and adjust all controls for normal "AM" operation. Disconnect the antenna and adjust A6 for maximum background noise.  
The NFM-50 adaptor unit is pre-aligned at the factory and realignment should not be required unless the adaptor is accidentally misaligned.  
If the adaptor requires alignment set the controls as follows: Control switch to "NFM", the selectively switch to "OFF", the limiter control to "OFF", the B+ switch to "ON", the AVC switch to "AVC", the RF gain control to "10". Plug in coil set "E", if available, if not plug in coil set "D".

DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	COIL SET	RADIO DIAL SETTING	CONNECT VTVM	ADJUST	REMARKS
75.	3000 carbon res.	High side thru antenna terminal "A". Low side to other antenna terminal "A".	1500KC (Unmod.) or 2.25MC	Band E	Tune for max. deflection.	DC Probe Common to chassis.	A136 A137 A138 Detune A136 and A137 by turning adjustment screws counter-clockwise as far as possible. Then adjust A136 for maximum deflection. Adjust A137 for zero reading.
76.	"	"	"	"	Not used	A138	Adjust for a null in audio output. Readjust A137 and A138 until a zero reading and a null in audio output is obtained.







# VOLTAGE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Top Cap
V 1	6BA6	±0V. #-.3VDC	1.4VDC	0V.	6.3VAC	245VDC	120VDC	1.4VDC		
V 2	6BA6	±0V. #-.3VDC	34VDC	0V.	6.3VAC	245VDC	120VDC	34VDC		
V 3	6BE6	0V.	1.2VDC	6.3VAC	0V.	245VDC	85VDC	0V.		
V 4	6C4	105VDC	0V.	6.3VAC	0V.	105VDC	§-7.6VDC	0V.		TOP CAP ±0V. #-.2VDC
V 5	6K7	0V.	0V.	245VDC	130VDC	37VDC	35VDC	6.3VAC	37VDC	±0V. #-.2VDC
V 6	6K7	0V.	0V.	245VDC	130VDC	35VDC	0V.	6.3VAC	35VDC	±0V. #-.2VDC
V 7	6J7	0V.	0V.	¶60VDC	¶22VDC	0V.	¶245VDC	6.3VAC	0V.	-.4VDC
V 8	6H6	0V.	0V.	-.5VDC	0V.	-3VDC	-3VDC	5VAC	0V.	
V 9	6SN7GT	±0V. #-.6VDC	30VDC	0V.	30VDC	190VDC	80VDC	0V.	6.3VAC	
V 10	6H6	0V.	0V.	42VDC ±0V.	42VDC ±0V.	42VDC ±0V.	35VDC ±0V.	5VAC	42VDC ±0V.	
V 11	6SJ7	0V.	0V.	4.7VDC	0V.	4.7VDC	115VDC	6.3VAC	34VDC	
V 12	6V6GT	0V.	0V.	245VDC	250VDC	0V.	245VDC	6.3VAC	16VDC	
V 13	6V6GT	0V.	0V.	245VDC	250VDC	0V.	250VDC	6.3VAC	16VDC	
V 14	OB2	105VDC	0V.	0V.	0V.	105VDC	0V.	0V.		
V 15	5U4G	0V.	285VDC	0V.	255VAC	0V.	255VAC	0V.	285VDC	
V 16	6AK6	±-.5VDC	0V.	0V.	6.3VAC	±3.4VDC	±70VDC	0V.		
V 17	6SK7	0V.	0V.	7.3VDC	0V.	7.3VDC	120VDC	6.3VAC	210VDC	
V 18	6H6	0V.	0V.	-.1VDC	.4VDC	-.4VDC	-.4VDC	6.3VAC	-.1VDC	

FUNCTION SWITCH IN "AM" POSITION UNLESS OTHERWISE NOTED.  
 LIMITER SWITCH "OFF" UNLESS OTHERWISE NOTED.  
 B+ SWITCH MUST BE ON FOR THESE MEASUREMENTS.  
 CALIBRATION SWITCH "OFF" UNLESS OTHERWISE NOTED.  
 ▲ AVC SWITCH "OFF".  
 # AVC SWITCH "ON".  
 ▲ LIMITER SWITCH "ON" AND CONTROL TURNED CLOCKWISE.  
 ¶ FUNCTION SWITCH IN "CW" POSITION.  
 ♦ CALIBRATION SWITCH 100 or 1000 POSITION.  
 § TAKEN WITH VACUUM TUBE VOLTMETER.

# RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Top Cap
V 1	6BA6	±470KΩ #3.5Meg.	100Ω	0Ω	.1Ω	†290Ω	†17KΩ	100Ω		
V 2	6BA6	±470KΩ #3.5 Meg.	10KΩ	0Ω	.1Ω	†290Ω	†17KΩ	10KΩ		
V 3	6BE6	22KΩ	220Ω	.1Ω	0Ω	†290Ω	†33KΩ	.1Ω		
V 4	6C4	†5.3KΩ	0Ω	.1Ω	0Ω	†5.3KΩ	22KΩ	0Ω		±470KΩ #3.5 Meg.
V 5	6K7	0Ω	0Ω	†2.5KΩ	†15KΩ	10KΩ	10KΩ	.1Ω	10KΩ	±470KΩ #3.5 Meg.
V 6	6K7	0Ω	0Ω	†2.5KΩ	†15KΩ	10KΩ	Inf.	.1Ω	10KΩ	47KΩ
V 7	6J7	0Ω	0Ω	††120KΩ ±750KΩ	††100KΩ	0Ω 150KΩ ±300KΩ	††290Ω 150KΩ ±300KΩ	.1Ω	2Ω	
V 8	6H6	0Ω	0Ω	±1.5 Meg.	0Ω			2.5Ω	0Ω	
V 9	6SN7GT	#3 Meg.	†50KΩ	0Ω	270KΩ	†47KΩ	50KΩ	0Ω	.1Ω	
V 10	6H6	0Ω	0Ω	†1 Meg. †±350KΩ	220KΩ ±500KΩ	†1.3Meg. †±600KΩ	†1.5 Meg. †±800KΩ	2.5Ω	220KΩ 500KΩ	
V 11	6SJ7	0Ω	0Ω	2.3KΩ	100Ω	2.3KΩ	†147KΩ	.1Ω	†147KΩ	
V 12	6V6GT	0Ω	0Ω	†340Ω	†290Ω	220KΩ	†340Ω	.1Ω	220Ω	
V 13	6V6GT	0Ω	0Ω	†340Ω	†290Ω	220KΩ	†290Ω	.1Ω	220Ω	
V 14	OB2	†5.3KΩ	0Ω	Inf.	0Ω	†5.3KΩ	Inf.	0Ω		
V 15	5U4G	Inf.	45KΩ	Inf.	115Ω	Inf.	115Ω	Inf.	45KΩ	
V 16	6AK6	4.7 Meg.	0Ω	0Ω	.1Ω	†±470KΩ	†±22KΩ	0Ω		
V 17	6SK7	0Ω	0Ω	1000Ω	1 Meg.	1000Ω	†50KΩ	.1Ω	†5KΩ	
V 18	6H6	0Ω	0Ω	Inf.	15KΩ	15KΩ	15KΩ	.1Ω	Inf.	

FUNCTION SWITCH IN "AM" POSITION UNLESS OTHERWISE NOTED.  
 LIMITER SWITCH OFF UNLESS OTHERWISE NOTED.  
 B+ SWITCH MUST BE ON FOR THESE MEASUREMENTS.  
 CALIBRATION SWITCH "OFF" UNLESS OTHERWISE NOTED.  
 ▲ AVC SWITCH "OFF".  
 # AVC SWITCH "ON".  
 ▲ LIMITER SWITCH "ON" AND CONTROL TURNED CLOCKWISE.  
 † MEASURED FROM PIN 8 OF V15.  
 ¶ FUNCTION SWITCH IN "CW" POSITION.  
 ♦ CALIBRATION SWITCH IN 100 or 1000 POSITION.

- DC-Voltage measurements are at 20,000 ohms per volt; AC Voltages measured at 1,000 ohms.
- Socket connections are shown as bottom views.
- Measured values are from socket pin to common negative.
- Line voltage maintained at 117 volts for voltage readings.
- Nominal tolerance on component values makes possible a variation of ±15% in voltage and resistance readings.
- Volume control at maximum, no signal applied for voltage measurements.







**ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT**

10. To set the main tuning dial turn the tuning gang fully closed, loosen set screws and turn the dial slowly until the dial reads zero.  
To set pointer, set the band selector until the band "D" scale appears and turn the main tuning dial to 490 and set pointer to 4MC reference mark on dial scale.

**IF ALIGNMENT "CHECK" TO BE MADE PRIOR TO ALIGNMENT**

- (a) Set the AVC switch to "OFF", the control switch to "CW", the phasing control at zero, the selectivity switch at "5" and the RF gain control at 10.  
(b) Vary the CWO control to point of lowest background noise and note the setting.  
(c) Turn the selectivity switch to "OFF" position, and adjust "CWO" control to point of lowest background noise and note the setting.  
(d) If IF Alignment is correct the two settings (b) and (c) should coincide and steps 1 thru 6 may be omitted.

**IF ALIGNMENT**

12. Controls should be set as follows except where noted otherwise: Set the control switch to "CW", the AVC switch to "OFF", the phasing control to zero, the selectivity switch to "5", the AF gain control to 10, and the RF gain control to 9.

PRIMARY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	COIL SET	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
Direct	High side to pin 7 (Grid) of 6BE6 (V3). Low side to chassis.	453KC (Unmod.)	Any	Tuning gang fully open	Across voice coil		Adjust the "CWO" control for audio beat-note. If it is difficult to obtain the beat note, an adjustment of A1 will be required. Vary the signal generator between 453 and 457KC for a sharp peak response. Set the generator at this peak for IF Alignment.
Direct	"	As set in step 1	"	"	"	A2, A3, A4, A5, A6, A7	Set the selectivity switch to "OFF", the control switch to "AM" position. Turn modulation of signal generator on. Adjust for maximum output.
Direct	"	Two KC above frequency determined in step 1	"	"	"	A2.	Set the selectivity switch to "I" and adjust A2 for maximum output.
Direct	"	Exact frequency determined in step 1	"	"	"	A8	Turn selectivity switch to "OFF" position. Adjust for maximum output.

16. The phasing control is pre-set at the factory, and should not require adjustment, when correctly set a decrease in the background level will be noted with the selectivity switch at "5" and the phasing control at zero. If not, a slight adjustment of A9 will be required for proper setting.

17. Turn modulation of signal generator off and set control switch to "CW" position. Turn the "CWO" control fully clockwise and set knob to "5" on its scale. Adjust "CWO" control to zero beat with signal generator. If zero beat does not occur at "0" on the control dial a careful readjustment of A1 will be required.

**GENERAL COVERAGE ALIGNMENT**

17. Set all controls as follows: Set the control switch to "AM", the AVC switch to "OFF", the selectivity switch to "OFF", the RF gain control to 10, the bandspread switch to the general coverage position.  
The position of the antenna and oscillator trimmers should be with the arrows of these controls in a vertical position.

DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	COIL SET	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
400K carbon res.	High side antenna terminal "A". Low side to chassis.	30MC (400 % Mod.)	Band A	30MC	Across voice coil	A10 (pos. 8)	Adjust until signal is heard. Tune signal generator to 30.91 MC. If signal is not heard, retune generator to 30MC and open A10 to next peak. Adjust for maximum output and retcheck for image.
"	"	"	"	"	"	A11 (pos. 6)	Adjust for maximum output.
"	"	"	"	"	"	A12 (pos. 4)	"
"	"	14.4MC	"	Tune for max. output	"	A13 (pos. 16)	Adjust A13 until signal is heard. Adjust A14, A15 and A16 for maximum output. Repeat steps 7, 8, and 9 until no further improvement can be made.

400K carbon res.	High side antenna terminal "A". Low side to chassis.	14.4MC	Band B	14.4MC	Across voice coil	A17 (pos. 8)	Adjust until signal is heard. Tune signal generator to 15.31 MC. If no signal is heard, retune generator to 14.4MC and open A17 to next peak. Adjust for maximum output and retcheck for image.
"	"	14.4MC	"	14.4MC	"	A18 (pos. 6)	Adjust for maximum output.
"	"	7MC	"	Tune for max. output	"	A19 (pos. 4)	"
"	"	7.3MC	Band C	7.3MC	"	A20 (pos. 2)	"
"	"	"	"	"	"	A21 (pos. 16)	Adjust A21 until signal is heard. Adjust A22, A23 and A24 for maximum output. Repeat steps 10, 11 and 12 until no further improvement can be made.
"	"	"	"	"	"	A22 (pos. 13)	"
"	"	"	"	"	"	A23 (pos. 11)	"
"	"	"	"	"	"	A24 (pos. 9)	"
"	"	"	"	"	"	A25 (pos. 8)	Adjust until signal is heard. Tune signal generator to 8.21MC. If signal is not heard retune generator to 7.3MC and open A25 to next peak and adjust for maximum output and retcheck for image.
"	"	"	"	"	"	A26 (pos. 6)	Adjust for maximum output.
"	"	"	"	"	"	A27 (pos. 4)	"
"	"	"	"	"	"	A28 (pos. 2)	"
"	"	3.5MC	"	Tune for max. output	"	A29 (pos. 16)	Adjust A29 until signal is heard. Adjust A30, A31 and A32 for maximum output. Repeat steps 13, 14 and 15 until no further improvement can be made.
"	"	"	"	"	"	A30 (pos. 13)	"
"	"	"	"	"	"	A31 (pos. 11)	"
"	"	"	"	"	"	A32 (pos. 9)	"
"	"	4MC	Band D	4MC	"	A33 (pos. 8)	Adjust until signal is heard. Tune signal generator to 4.91 MC. If no signal is heard, retune generator to 4MC and open A33 to next peak. Adjust for maximum output and retcheck for image.
"	"	"	"	"	"	A34 (pos. 6)	Adjust for maximum output.
"	"	"	"	"	"	A35 (pos. 4)	"
"	"	1.8MC	"	Tune for max. output	"	A36 (pos. 16)	Adjust A36 until signal is heard. Adjust A37, A38 and A39 for maximum output. Repeat steps 16, 17 and 18 until no further improvement can be made.
"	"	"	"	"	"	A37 (pos. 13)	"
"	"	"	"	"	"	A38 (pos. 11)	"
"	"	2MC	Band E	2MC	"	A39 (pos. 9)	"
"	"	"	"	"	"	A40 (pos. 8)	Adjust until signal is heard. Tune signal generator to 2.91 MC. If signal is not heard, retune generator to 2MC and open A40 to next peak. Adjust for maximum output and retcheck for image.

## ALIGNMENT INSTRUCTIONS (CONT.)

ALIGNMENT INSTRUCTIONS (CONT.)

20.	4000 carbon res.	High side antenna terminals "A". Low side to chassis.	2MC	Band E	2MC	Across voice coil	A41 (pos. 6) A42 (pos. 4)	Adjust for maximum output.	35.	4000 carbon res.	High side antenna terminals "A". Low side to chassis.	100KC	Band J	100KC	Across voice coil	A62 (pos. 8)	Adjust until signal is heard. Tune signal generator to 100KC. If signal is not heard, retune generator to 100KC and open A62 to next peak. Adjust for maximum output and recheck for image.
21.	"	"	1MC	"	Tune for max. output	"	A43 (pos. 7)	Adjust until signal is heard.	36.	"	"	"	"	"	"	A63 (pos. 6) A64 (pos. 4) A65 (pos. 2)	Adjust for maximum output.
22.	"	"	1.4MC	"	"	"	A44 (pos. 16)	Adjust until signal is heard. Repeat steps 18 thru 22 until no further improvement can be made.	37.	"	"	50KC	"	50KC	"	A66 (pos. 7)	Adjust until signal is heard.
23.	"	"	900KC	Band F	900KC	"	A45 (pos. 8)	Adjust until signal is heard. Tune signal generator to 1.81MC. If signal is not heard, retune generator to 900KC and open A45 to next peak. Adjust for maximum output and recheck for image.	38.	"	"	75KC	"	75KC	"	A67 (pos. 16)	Adjust until signal is heard. Repeat steps 35, 36, 37 and 38 until no further improvement can be made.
24.	"	"	"	"	"	"	A46 (pos. 6) A47 (pos. 4) A48 (pos. 2)	Adjust for maximum output.	39.	"	"	30MC	Band AA	30MC	"	A68 (pos. 7)	Adjust until signal is heard. Tune signal generator to 30.91 MC. If no signal is heard, retune generator to 30MC and open A68 to next peak. Adjust for maximum output and recheck for image.
25.	"	"	500KC	"	500KC	"	A49 (pos. 7)	Adjust until signal is heard.	40.	"	"	"	"	"	"	A69 (pos. 5) A70 (pos. 3) A71 (pos. 1)	Adjust for maximum output.
26.	"	"	700KC	"	700KC	"	A50 (pos. 16)	Adjust until signal is heard. Repeat steps 23, 24, 25 and 26 until no further improvement can be made.	41.	"	"	27.2MC	"	Tune for max. output	"	A72 (pos. 8) A73 (pos. 6) A74 (pos. 4) A75 (pos. 2)	Adjust A72 until signal is heard. Adjust A73, A74 and A75 for maximum output.
27.	"	"	400KC	Band G	400KC	"	A51 (pos. 8)	Adjust until signal is heard. Tune signal generator to 1310 KC. If signal is not heard, retune generator to 400KC and open A51 to next peak. Adjust for maximum output and recheck for image.	42.	"	"	28MC	"	"	"	A76 (pos. 16) A77 (pos. 13) A78 (pos. 11) A79 (pos. 9)	Adjust A76 until signal is heard. Adjust A77, A78 and A79 for maximum output. Repeat steps 39, 40, 41 and 42 until no further improvement can be made.
28.	"	"	"	"	"	"	A52 (pos. 6) A53 (pos. 4)	Adjust for maximum output.	43.	"	"	35MC	Band AB	35MC	"	A80 (pos. 8)	Adjust until signal is heard. Tune signal generator to 35.91 MC. If signal is not heard, retune generator to 35MC and open A80 to next peak. Adjust for maximum output and recheck for image.
29.	"	"	200KC	"	200KC	"	A54 (pos. 7)	Adjust until signal is heard.	44.	"	"	"	"	"	"	A81 (pos. 6) A82 (pos. 4) A83 (pos. 2)	Adjust for maximum output.
30.	"	"	300KC	"	300KC	"	A55 (pos. 16)	Adjust until signal is heard. Repeat steps 27, 28, 29 and 30 until no further improvement can be made.	45.	"	"	25MC	"	Tune for max. output	"	A84 (pos. 7) A85 (pos. 5) A86 (pos. 3) A87 (pos. 1)	Adjust A84 until signal is heard. Adjust A85, A86 and A87 for maximum output.
31.	"	"	200KC	Band H	200KC	"	A56 (pos. 8)	Adjust until signal is heard. Tune signal generator to 110KC. If signal is not heard, retune generator to 200KC and open A56 to next peak. Adjust for maximum output and recheck for image.									
32.	"	"	"	"	"	"	A57 (pos. 6) A58 (pos. 4) A59 (pos. 2)	Adjust for maximum output.									
33.	"	"	100KC	"	100KC	"	A60 (pos. 7)	Adjust until signal is heard.									
34.	"	"	150KC	"	150KC	"	A61 (pos. 16)	Adjust until signal is heard. Repeat steps 31, 32, 33 and 34 until no further improvement can be made.									
35.																	

SET 112

FOLDER 7

SET 112

FOLDER 7